



US Army Corps  
of Engineers

# DCAF Bulletin

## Design Construction Analysis Feedback

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CEMP-C

**Subject:** Structural Steel Construction

**Applicability:** Information

- REFERENCE:
1. ER 1110-345-53, Structural Steel Connections
  2. CEGS 05120, Structural Steel
  3. AISC S329, Allowable Stress Design Specification for Structural Joints Using ASTM A325 or A490 Bolts
  4. AISC S334L, Load and Resistance Factor Design Specification for Structural Joints Using ASTM A325 or A490 Bolts

1. The following is a list of the 5 most frequently found deficiencies associated with structural steel construction on Corps of Engineer projects.

a. OBSERVATION: Structural Steel shop drawings are not being required to be approved by the government or are being approved by the resident office.

REQUIREMENT: ER 1110-345-53, Structural Steel Connections, dated 22 July 1994, prescribes the policy and procedures for the design and approval of structural steel connections for military construction projects. It states that the design responsibility for in-house or Architect-Engineer (A-E) design of all structural steel connections will remain with the Corps designer or the A-E firm respectively. For in-house design or A-E design, the connection shop drawings will be reviewed and approval recommended by the Engineer of Record (EOR). In cases where simple connections are not shown on the contract documents, the design responsibility will be retained by the Corps of Engineers designer or the A-E firm respectively, through the shop drawing review and approval process. When doing your Biddability, Constructability, Operability and Environmental review on a project that contains structural steel you should check that the necessary submittals requiring government approval have been specified. CEGS 05120, Structural Steel, requires submittal of all structural connection shop drawings for government approval. The field office can review the shop drawings but they cannot be approved by the ACO without the recommendation of the EOR.

b. OBSERVATION: Structural steel fabrication plant is not certified by the American Institute of Steel Construction, Incorporated (AISC), or certificates are not submitted, when the specifications require the submittal.

REQUIREMENT: Not all contracts require the fabrication plant be certified if the design is simple and the quantity of steel is small. If there are any moment connections involved then certification is recommended. The final determination of whether certification is required is made by the designer. When certification is required then this should be noted in the job specific Quality Assurance (QA) plan. The submittals should be reviewed before the preparatory inspection meeting to be assured that the proper certification has been submitted and that the steel on the job was manufactured at the plant listed in the certification.

c. OBSERVATION: High strength bolts installed in structural steel frame buildings are often not properly tested for required tension values by either the Contractor Quality Control (CQC) representative or QA representatives.

REQUIREMENT: When there are bolts in slip critical or direct tension connections they must be installed and tested in accordance with the requirements of AISC-04 per the contract. AISC-04 has been redesignated by AISC to AISC S335. This specification is used in conjunction with AISC S329. This reference states that the bolts can be tightened by either the turn of nut method, calibrated wrench or direct tension indicator. When the turn of the nut method is used, Table 5, in AISC S329, provides the rotation required from the snug tight condition, based on the bolt length, to be achieved to reach specified tension. The calibrated wrench method can be used only when installation procedures are calibrated on a daily basis and when a hardened washer is used under the element turned in tightening. The calibration must be checked each day for each bolt diameter, length and grade using fastener assemblies that are being installed in the work. Calibration shall be checked in a device capable of indicating the actual bolt tension, such as a portable Skidmore-Whilhelm testing device, by tightening three typical bolts of each type to be used. It shall be verified during actual installation in the assembled steelwork that the wrench adjustment selected by the calibration does not produce a nut or bolt head rotation greater than that permitted in Table 5.

It is the responsibility of the construction contractor to submit his erection procedures and tell you the procedures he is going to use to install his fasteners. These procedures should be thoroughly reviewed at the preparatory meeting and then again at the initial inspection meeting. The contractors CQC representative must fully document his inspection procedures used to determine that the installation is in conformance with the specification requirements. For further details on the requirements of the AISC it is necessary to have access to the referenced publications. These are available if you have access to the CD-Rom based "Construction Criteria Base" (CCB). They can be found under the Reference Libraries, sub heading "Private Industry Standards".

d. OBSERVATION: Column base plates and bearing plates are not being provided with full bearing before loads are applied to the structure.

REQUIREMENT: CEGS 05120 requires that base plates and bearing plates shall be provided with full bearing after the supported members have been plumbed and properly positioned, but prior to placing superimposed loads. The area under the plate shall be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. This requirement should be covered at the preparatory inspection meeting.

e. OBSERVATION: Structural steel welds, bolt heads and nuts are not being field primed as required by the contract.

REQUIREMENT: CEGS 05120, paragraph 3.2.4, Field Priming, states "After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat". The requirement to do the touch up painting should be raised at the preparatory meeting as it is usually an item of dispute between the prime contractor and his steel erector and painter as to who is responsible for it. This requirement should be ironed out before the work starts.

2. The use of counterfeit bolts is still a problem in the construction industry. There are several things that we can do to try and eliminate their use on Corps projects. The specifications require the contractor to submit certified mill test reports and samples of the nuts, bolts and washers to be used on the project. At the preparatory inspection we must assure ourselves that the certified mill test reports have been submitted, that the samples have been submitted and that the structural fasteners in the field match the samples submitted. It is fairly easy to falsify mill test reports so that you should ask for an original signature. To assure yourself that the bolts on the job are actually from the approved manufacture there is a publication available called Manufacturer Identification Symbols which lists all manufactures and shows their correct identification marks. The latest edition of this manual is dated 1995 and is available from Fastener Technology International Magazine, 3869 Darrow Rd., Suite 101, Stow, OH 44224 (Phone 216-6869544).

3. Neither we nor our contractors can do our jobs well without the proper references. Our job of quality assurance is always made easier if the contractor understands and performs the required quality control duties in accordance with the contract. This starts at the meeting of mutual understanding where the contractor is made aware of our expectations that he/she is responsible for the quality of the construction and will be expected to properly document actions to obtain this quality. It continues when we attend the preparatory inspection meetings and assure ourselves that the contractor understands the requirements for the work feature involved and has all the reference documents and approvals necessary to assure that the work is in accordance with the contract. When we have attended the initial inspection and approved the quality and documented our actions, we have assured ourselves that the contractor has met the contract requirements. The follow up inspections document that the contractor is continuing to meet the quality requirements. Properly prepared documentation is the proof that the contractor and we have done our jobs.

This DCAF Bulletin has been coordinated with Technical Engineer Branch of the Directorate of Military Programs (CEMP-ET).



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